

REMARKS

Status of the Claims

Claims 1-2, 4-6 and 8-36 stand rejected under Section 102(b) as being anticipated by U.S. Patent No. 5,444,786 to Raviv (Raviv). Claim 3 stands rejected under Section 103(a) as being unpatentable over Raviv in view of U.S. Patent No. 6,665,410 to Parkins (Parkins). Claim 7 stands rejected under Section 103(a) as being unpatentable over Raviv in view of what the Action refers to as Raviv's admitted prior art.

Applicants hereby request further consideration of the application in view of the amendments above and the comments that follow.

The Rejections under Sections 102 and 103

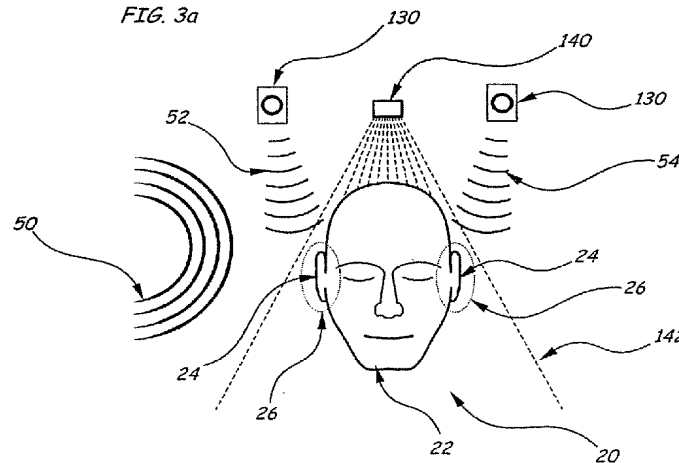
I. The Independent Claims

A. Claim 1

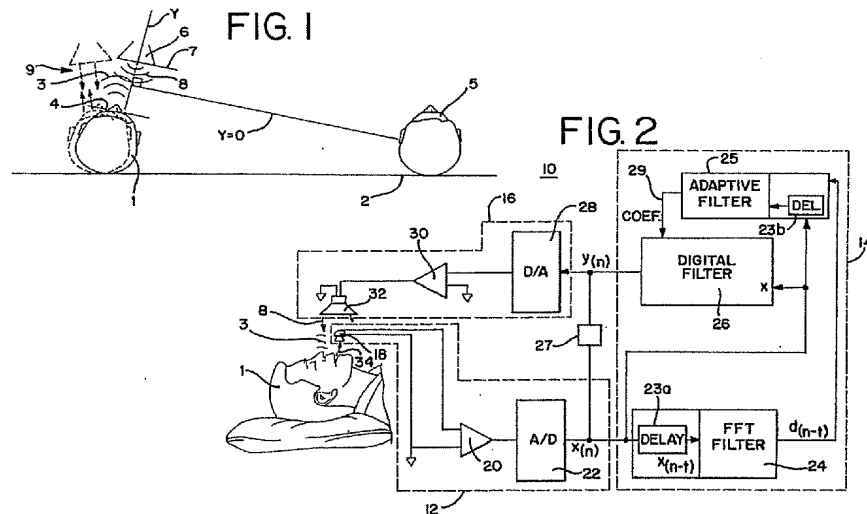
Claim 1 recites a system for sound cancellation including:

- a source microphone for detecting sound propagating from a sound source;
- a speaker configured to direct a canceling sound toward a cancellation location that is spatially remote from the sound source, and
- a computational module in communication with the microphone and the speaker, the computational module configured to receive a signal from the microphone, identify a cancellation signal using a predetermined adaptive filtering function responsive to an acoustic environment of the cancellation location, and transmit a cancellation signal to the speaker.

Claim 1 has been amended to clarify that the speaker is configured to direct a canceling sound toward a cancellation location that is spatially remotely from the sound source. For example, as shown in **Figure 3a** of Applicants' Specification (reproduced below), the speakers **130** may produce a cancellation space **26** with respect to the ears **24** of the bed partner **20** by directing canceling sounds **52, 54** toward the ears **24**. The cancellation space **26** is spatially remote from source of the snore sound **50**. *See Applicants' Specification, paragraph 40.*



In contrast, Raviv proposes a speaker 6 that emits a snore-canceling signal 8 towards the sound source, *i.e.*, in an opposing direction to that of the snore signal 3 and towards the snore source 4. As can be seen, for example, in **Figures 1-2**, the speaker 6 moves so that the snore canceling signal 8 is emitted towards the snore source 4 in an opposing direction along the Y-plane. *See* Raviv, column 5, line 51 – column 6, line 11.



In addition, there is no apparent reason to modify Raviv to direct a canceling signal toward a cancellation location that is remote from the source of the sound as recited in Claim 1. Raviv discusses that propagation of the snore-canceling signal 8 in a direction along the

Y-plane provides suppression of snoring signals at more than one point, which Raviv refers to as "global suppression." *See* column 6, lines 8-11. The techniques proposed by Raviv appear to be inoperable if the snore-canceling signal were directed somewhere other than towards the snore source, and therefore, Raviv teaches away from a speaker configured to direct a canceling sound toward a cancellation location that is spatially remote from the sound source as recited in Claim 1.

Embodiments according to the current invention direct canceling sounds to a cancellation location that is spatially remote from the sound source. In particular embodiments, the canceling sounds can take into account the acoustic environment (*e.g.*, reverberations) of the room. Applicants submit that Raviv (which proposes directing a canceling signal towards the sound source for "global suppression") does not appreciate these advantages.

For at least these reasons, Raviv does not disclose or render obvious the recitations of Claim 1. Claims 2-17 depend from Claim 1 and are likewise patentable over the cited art. Accordingly, Applicants request that the rejections under 35 U.S.C. 102/103 of Claims 1-17 be withdrawn.

B. Claim 18

Claim 18 recites a method of sound cancellation comprising:

- detecting a sound input at an input location that is spatially remote from a sound source;
- identifying a cancellation signal for the sound input with respect to a cancellation location that is spatially remote from the sound source using a predetermined adaptive filtering function; and
- broadcasting a cancellation sound for canceling sound proximate the cancellation location in a direction toward the cancellation location.

As noted above with respect to Claim 1, Raviv proposes directing a canceling signal **8** towards a snore source 4 to provide "global suppression." Accordingly, Raviv does not disclose or render obvious "broadcasting a cancellation sound for canceling sound proximate

the cancellation location in a direction toward the cancellation location" and the cancellation is spatially remote from the sound source as recited in Claim 18.

For at least these reasons, Raviv does not disclose or render obvious the recitations of Claim 18. Claims 19-23 depend from Claim 18 and are likewise patentable over the cited art. Accordingly, Applicants request that the rejections under 35 U.S.C. 102 of Claims 18-23 be withdrawn.

C. Claim 24

Claim 24 recites a method for canceling sound including:

- detecting first sound at a first location;
- detecting a modified second sound at a second location, the modified second sound being a result of sound propagating to the second location;
- determining an adaptive filtering function, the adaptive filtering function approximating the second modified sound from the first sound;
- halting detecting of the modified sound; and
- determining a cancellation signal proximate the second location from the first sound and the adaptive filtering function.

The Action states that "Claim 24 has been analyzed and rejected according to Claim 1." *See* the Action, page 5. However, Claim 24 includes recitations that are different from those of Claim 1, which are not discussed in the Action and are not disclosed by Raviv.

In particular, the system proposed by Raviv, which directs an inverted canceling signal **8** towards the snore source **4**, does not determine an adaptive filtering function that approximates the second modified sound from the first sound, where the modified second sound is the result of sound propagating to the second location. In addition, Raviv does not disclose halting detecting of the modified sound and determining a cancellation signal proximate the second location from the first sound and the adaptive filtering function. In fact, column 3, lines 58-62 of Raviv discuss an adaptive filtering mechanism for determining and generating a snore canceling signal based on an analysis of a current snore signal, and as

such, Raviv teaches away from halting detecting of the modified sound as recited in Claim 24.

Accordingly, Applicants submit that Raviv does not disclose or render obvious the recitations of Claim 24 and it is requested that the rejections of Claim 24 under 35 U.S.C. 102 be withdrawn. However, if the rejection of Claim 24 is maintained in a subsequent Official Action, it is respectfully requested that the portions of Raviv that are alleged to disclose the recitations of Claim 24 be specifically identified.

D. Claim 25

Claim 25 recites a method for canceling sound, including:

- detecting a first sound at a first location;
- detecting a modified second sound at a second location, the modified second sound being a result of sound propagating to the second location; and
- determining an adaptive filtering function, the adaptive filtering function approximating the second modified sound from the first sound without requiring additional sound input from the second location.

Claim 25 has been amended to recite that the adaptive filtering function approximates the second modified sound from the first sound without requiring a sound input from the second location. Support for the amendments to Claim 25 can be found, for example, in paragraph 41 of Applicants' Specification.

The Action takes the position that the recitations of Claim 25 are disclosed in Raviv at column 3, lines 58-62 and column 4, lines 53-59. *See* the Action, pages 3-4 and page 5.

Although column 3, lines 58-62 of Raviv discuss an adaptive filtering mechanism for determining and generating a snore canceling signal based on an analysis of a current snore signal, Raviv discusses at column 3, lines 63 – column 4, line 8 that the microphone is located in a mouth piece placed in the mouth of the snoring person, and a signal processor generates the snore canceling signal based on the received snore signal. Column 4, lines 53-59 discuss an optional second microphone that is positioned to evaluate and adjust the suppressing effect of the system, such as a microphone located in a headset worn by an

adjacent person to determine the signal heard by the adjacent person. However, the second microphone appears to require a sound input during the snoring suppression to evaluate and adjust the suppression effect of the system. Accordingly, Applicants submit that Raviv does not disclose that the adaptive filtering function approximates the second modified sound from the first sound without requiring a sound input from the second location.

Thus, Applicants submit that Raviv does not disclose the recitations of Claim 25 and request that the rejections under 35 U.S.C. 102 be withdrawn.

E. Claim 26

Claim 26 recites a method for analyzing sound for health conditions including

providing a microphone spatially remote from a subject;
analyzing a sound input to the microphone to determine if a
change in respiratory sounds occurs sufficient to identify a health
condition comprising at least one of: sleep apnea, pulmonary
congestion, pulmonary edema, asthma, halted breathing, abnormal
breathing, arousal, and disturbed sleep.

The Action takes the position that Raviv discloses a screening module that analyzes signals from the source microphone for indications of abnormal breathing at column 3, lines 49-57. Claim 26 recites “analyzing a sound in put ... to determine if a change in respiratory sounds occurs sufficient to identify a health condition...” The cited portions of Raviv merely discuss a snoring suppression system. Nothing in Raviv discusses analyzing the signals to identify a health condition or determining if a change in respiratory sounds is sufficient to identify a health condition.

Accordingly, Applicants submit that Raviv does not disclose the recitations of Claim 26 and request that the rejections under 35 U.S.C. 102 be withdrawn.

F. Claims 27 and 31

Claim 27 recites a system for sound cancellation including:

a source microphone for detecting sound; and

a parametric speaker configured to transmit a canceling sound configured to cancel the detected sound such that the canceling sound is localized with respect to a cancellation location.

Claim 31 recites a method for canceling sound comprising:

detecting a sound; and
transmitting a canceling signal from a parametric speaker that locally cancels the sound with respect to a cancellation location.

The Action cites column 10, line 56 - column 11, line 6 and column 3, lines 62-65 of Raviv as allegedly disclosing the features of Claims 27 and 31.

Applicants submit that the ultrasonic sensors and ultrasonic transmitters discussed in Raviv do not transmit canceling sounds that are configured to cancel detected sounds. Raviv discusses that the ultrasonic sensors are used to determine which speaker is closest and/or has the best directional position to the source snore sound signal. *See* column 11, lines 33-35. The ultrasonic transmitter 48 is placed in the mouth piece of the person or on the microphone 18. The ultrasonic receivers 50a, 50b and 50c are located in speakers 42, 32 and 40, respectively. A speaker selector 58 receives the detected ultrasonic signals and determines which ultrasonic receiver 50a, 50b or 50c is receiving the strongest signal and can also determine the elapsed time for the signal to be received to determine the distance between the selected speaker and the snore source. *See* column 10, line 56 - column 11, line 6 (cited in the Action). The speakers 42, 32 and 40 are selectively activated to output a snore canceling signal. *See* column 10, lines 40-44. Therefore, the canceling signal is output by the speakers 42, 32 and 40 (which are apparently conventional speakers) and not the ultrasonic transmitter 48 (which is used to select one of the speakers 42, 32 and 40).

Accordingly, Raviv does not disclose transmitting a canceling signal from a parametric speaker. In addition, Raviv repeatedly emphasizes that the sound canceling system provides global suppression. *See, e.g.*, column 3, lines 14-18; column 3, lines 49-51; and column 6, lines 8-11. Accordingly, Raviv also does not disclose a canceling sound that is localized with respect to a cancellation location.

For at least these reasons, Raviv does not disclose or render obvious all of the recitations of Claims 27 and 31. Claims 28-30 depend from Claim 27 and Claims 32-36 depend from Claim 31 and are likewise patentable. Accordingly, Applicants request that the rejections under 35 U.S.C. 102 of Claims 27-36 be withdrawn.

II. Dependent Claims

In addition to the reasons presented above with respect to the independent claims, Applicants submit that at least certain dependent claims are patentable for at least the following reasons.

A. Claim 5

Claim 5 depends from Claim 1 and recites that the adaptive filtering function includes a function that identifies a sound transformation between the source microphone and the cancellation location without contemporaneous sound input at the cancellation location. The Action takes the position that this feature is disclosed in Raviv at column 6, lines 29-35. The cited portions of Raviv discusses delay stages that represent the delay incurred in accumulating signal samples for the fast Fourier Transform (FFT) stage 24 and the adaptive filter stage 25, both of which do not process signals in real time. However, the cited portions of Raviv refer to delays in signal processing and do not appear to relate to sound inputs. Notably, the sound signal receiving stage 12 appears to require continuous acquisition of sound input (*see, e.g.*, column 6, lines 17-18 (referring to a current digital snore sound signal)). Accordingly, Raviv does not disclose the recitations of Claim 5.

For at least these reasons, Applicants submit that Claim 5 is separately patentable and requests an indication of same.

B. Claim 16

Claim 16 depends from Claim 1 and recites “analyzing a sound input ... to determine if a change in respiratory sounds occurs sufficient to identify a health condition...” The cited portions of Raviv (column 3, lines 49-57) merely discuss a snoring suppression system.

Nothing in Raviv discusses analyzing the signals to identify a health condition or determining if a change in respiratory sounds is sufficient to identify a health condition.

For at least these reasons, Applicants submit that Claim 16 is separately patentable and requests an indication of same.

C. Claim 17

Claim 17 depends from Claim 16 and further recites a communicating module that communicates the detection of a health condition to a user. The Action takes the position that Raviv discloses this feature in column 10, line 56 - column 11, line 6. The cited portions of Raviv discuss tracking the location of a snorer as discussed above with respect to Claim 27 and 31. Although Raviv detects snoring sounds, Applicants cannot locate any portion of Raviv that detects a health condition or communicates a health condition to a user.

For at least these reasons, Applicants submit that Claim 17 is separately patentable and requests an indication of same.

D. Claim 23

Claim 23 depends from Claim 18 and recites analyzing the sound input for medical screening purposes. Applicants submit that Raviv does not disclose analyzing sound for medical screening purposes for similar reasons as discussed above with respect to Claims 16-17. Raviv is merely concerned with canceling sound and Applicants cannot locate any portion of Raviv that is related to medical screening purposes or any medical issues related to sound signals.

For at least these reasons, Applicants submit that Claim 23 is separately patentable and requests an indication of same.

E. Claim 28

Claim 28 depends from Claim 27 and recites that the parametric speaker produces the canceling sound with an interaction between two or more ultrasonic signals. As discussed in

Applicants' Specification in paragraphs 72-73, the parametric speakers emit ultrasonic signals (normally beyond the range of human hearing), which interact with each other to form audible signals of limitable spatial extent.

The Action takes the position that the features of Claim 28 are disclosed by the speakers 42, 32, 40 of Figure 4b in Raviv. However, the speakers 42, 32, 40 of Raviv are not ultrasonic speakers. As discussed with respect to Claims 27 and 31, Raviv discusses an ultrasonic transmitter 48 that is placed in the mouth piece of the person or on the microphone 18. The ultrasonic receivers 50a, 50b and 50c are located in speakers 42, 32 and 40, respectively. A speaker selector 58 receives the detected ultrasonic signals and determines which ultrasonic receiver 50a, 50b or 50c is receiving the strongest signal and can also determine the elapsed time for the signal to be received to determine the distance between the selected speaker and the snore source. *See* column 10, line 56 - column 11, line 6 (cited in the Action). The speakers 42, 32 and 40 are selectively activated to output a snore canceling signal. *See* column 10, lines 40-44. Therefore, the canceling signal is output by one of the speakers 42, 32 and 40 (which are not ultrasonic speakers).

Moreover, Raviv discusses global suppression of snoring sounds, and therefore, Applicants submit that Raviv teaches away from signals that interact with each other to form audible signals of limitable spatial extent as recited in Claim 28.

For at least these reasons, Applicants submit that Claim 28 is separately patentable and requests an indication of same.

F. Claims 32 and 34

Claim 32 depends from Claim 31 and recites the step of transmitting a plurality of ultrasonic signals and that the canceling signal is formed from the interaction of the plurality of ultrasonic signals.

Claim 34 depends from Claim 31 and recites that the canceling signal is formed from an interaction between a plurality of ultrasonic signals that creates a difference signal among the ultrasonic signals at the cancellation location.

As discussed above with respect to Claim 28, the ultrasonic transmitter 48 of Raviv are used for locating the placement of the snorer and do not emit a canceling sound. The speakers 42, 32 and 40 of Raviv do not emit ultrasonic signals. Therefore, Raviv does not disclose the recitations of Claims 32 and 34.

For at least these reasons, Applicants submit that Claims 32 and 34 are separately patentable and requests an indication of same.

G. New Claims 37 and 38

Claim 37 depends from Claim 1 and further recites that the sound source comprises a snoring individual and the speaker is not wearable by the snoring individual. Support for new Claim 37 can be found, for example, in Applicants' Specification in Figure 1 and paragraphs 35-36. Applicants submit that these features are not disclosed or rendered obvious by the cited art, and therefore, Claim 37 is separately patentable.

Claim 38 depends from Claim 1 and further recites that the predetermined adapted filtering function includes a situational transfer matrix function, **W**,

$$\mathbf{W} = 1/(\mathbf{d}-\mathbf{c}*\mathbf{e})$$

wherein **c** is a transfer function for sound propagation from the sound source to the source microphone, **e** is a transfer function for sound propagation from the speaker to the cancellation location, and **d** is a transfer function for sound propagation from the source microphone to the speaker, and the * operator denotes mathematical convolution. Support for Claim 38 can be found, for example, in Applicants' Specification in paragraphs 53-55. Applicants submit that these features are not disclosed or rendered obvious by the cited art, and therefore Claim 38 is separately patentable.

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Application No.: 10/802,388
Filed: March 17, 2004
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Conclusion

Applicants respectfully submit that this application is now in condition for allowance, which action is requested. Should the Examiner have any matters outstanding of resolution, he is encouraged to telephone the undersigned at 919-854-1400 for expeditious handling.

Respectfully submitted,

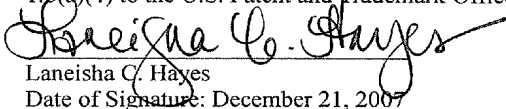


Laura M. Kelley
Registration No. 48,441
Attorney for Applicants

USPTO Customer No. 20792
Myers Bigel Sibley & Sajovec, P.A.
Post Office Box 37428
Raleigh, North Carolina 27627
Telephone: (919) 854-1400
Facsimile: (919) 854-1401

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Laneisha C. Hayes
Date of Signature: December 21, 2007